

BELLCOMM, INC.

SUBJECT: Trip Report - MSC, Apollo CM
Cabin (BP-1224) Combustion
Propagation Test - December 21,
1967 - Case 320

DATE: December 29, 1967

FROM: S. S. Fineblum

MEMORANDUM FOR FILE

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The writer recently witnessed two ignitions in the current series of CM cabin mockup (Boilerplate 1224) combustion propagation tests.

The tests have been performed as described in MSC test guidelines.* The procedure is similar to that in the LM (M-6) tests except that the TV and motion picture cameras are interior to the cabin and the termination criteria are more exact. In general, the results of six of the first ignitions have been similar to M-6 ignitions. Typically the ignitor increased in temperature with an eventual burn-through. The smoke or visible flame was very limited in both extent and duration. In these typical six ignitions the nearby thermocouples showed only a slight temperature rise indicating some heat transfer but no propagation from the point of ignition.

Ignitor for test 116 was located on a Neoprene-latex-coated saddle clamp which is on a wire bundle directly adjacent to a sheet of fluorinated-elastomer sound-abatement material in the cabin heat exchanger compartment. The ignition was attempted first with 9.1 amps through the ignitor, then at T+3 minutes, 38 seconds, the current was increased to 10 amps and at T+4 minutes, 32 seconds, the ignitor temperature had risen to 920°F with no sign of fire. Then ignitor current was further increased to 11 amps. About 30 seconds after higher current was imposed the ignitor temperature rose rapidly from 920°F to 1150°F and a flame was observed. About 13 seconds later the ignitor temperature was 1400°F, and the nearby thermocouples showed a sharp temperature rise and the ignitor failed open. Smoke began to appear and the nearby thermocouples indicated rapidly rising temperature (900°F, and 200°F at T+6 minutes) as the ignitor itself was becoming cooler. Smoke sharply increased at T+7 minutes. The nearby (6 inches from ignition) thermocouple rose to about 1000°F indicating propagation at T+9 minutes. The test was terminated at approximately T+10 minutes by opening the vent valve to vacuum. This venting caused a brief brightening of the visible flame. Soon (4 minutes), the ignitor and the two nearby thermocouple locations had cooled to about 600°F, 380°F and 450°F, respectively, and continued to cool.

*"Test Guidelines for Apollo Mockup Tests in Support of S/C 2TV-1 and 101," Structures and Mechanics Division, MSC, December 11, 1967, Report No. SMD-A2 (Rev. C)

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(NASA-CR-93076) TRIP REPORT - MSC, APOLLO
CM CABIN /BP-1224/ COMBUSTION PROPAGATION
TEST - DECEMBER 21, 1967 (Bellcomm, Inc.)
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When the cabin hatch was opened, an acrid odor was immediately evident. This odor is typical of combustion and pyrolysis products of fluorinated elastomers as noted in the M-6 tests.

It is important to note that apparently ignition did not occur with an ignitor temperature of over 900°F. The high (≈1000°F) ignition temperature in pure O₂ is indicative of significant fire resistance of these materials. However, NR is currently investigating a substitute or protection for the acoustical material which burnt or an improved installation.

The next ignition, number 117, was at a vertical wire bundle at a saddle clamp with silicon spacers. The results were typical of the tests thus far. The ignitor became very hot (≈2070°F), failed and slowly cooled. Some smoke for a minute and some slow warming of nearby clamps were the only visible consequences of this attempted ignition.

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2031-SSF-sam

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